

Lesson Plan
Subject/Course: Mathematics

Grade Level: Grade 10 Academic

Topic: Applied Trigonometry

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TC Names: Stephanie Romanello, Taylor O'Meara and Sylvia Liu

Date: February 11, 2014

Time of Class: 70 minutes

Location: Room 311

1. Curriculum Expectation(s) and Learning Goal(s) for the Lesson
a) Expectations: *(List 1-3 specific expectations from the Ontario Curriculum. Be realistic about how much you can accomplish in one lesson.)*

- Solve problems involving the measures of sides and angles in right triangles in real-life applications (eg., in surveying, in navigating, in determining the height of a building), using primary trigonometric ratios and the Pythagorean theorem.

b) Learning Goal(s): *(In your own words, what do you want the students to have learned by the end of the lesson? How will you know what they have learned the information?)*

Students will:

- Identify the hypotenuse of a right triangle
- Utilize the pythagorean theorem to solve right triangles
- Differentiate between the opposite and adjacent in a triangle
- Use the primary trigonometric ratios to solve real-world application problems

c) Success Criteria: *(The "I can" statements that specifically outline what the students need to do in order to achieve the learning goal)*

I can:

- Determine both the side lengths of and the angles contained in a triangle
- Utilize the pythagorean theorem to solve right triangles
- Differentiate between the opposite and adjacent in a triangle
- Use the primary trigonometric ratios to solve real-world application problems

2. Overview of the Lesson *(Write the information that you will provide to the students as the intro to the lesson. This may be written on chart paper, white/blackboard, Smart board. This will provide an overview of the lesson and/or list key elements. You may also include a review of the previous day's work. This information will inform the students/EAs about what to expect during the lesson.)*

- Introduction
 - Minds On--Taylor
- Instruction & Application
 - Review of primary trig ratios (SOHCAHTOA)-- Sylvia
 - TPS/Group work or activity on a challenge problem/take up problem-- Taylor
 - Independent/group work-- homework time-- Steph
- Consolidation & Assessment
 - Ticket out the door/consolidation activity-- Sylvia

3. Resources: List all the sources that you used to prepare the lesson along with all the materials that you require for the class. Be specific about what you will need during the class with numbers of the items.

Resources required are as follow:

- Lesson Plan & Worksheets (x25)
- Grade 11 Academic Mathematics textbook
- Papers, Pencils & Calculators (x10)
- Clicker sets
- Smartboard
- Laptop
- GeoGebra App.
- Youtube video clip
- MS. Excel

4. Content and Teaching Strategies for Lesson *(This section should provide sufficient detail that another teacher could step in and teach the lesson using this outline)*

6.a. Introduction: *Hook, Minds-On (how you will motivate students, get their attention)*

Timing: 3mins

Show this video:

<http://www.youtube.com/watch?v=t2uPYYLH4Zo>

6.b. Instruction: *Organization and delivery of the content using effective instructional strategies and processes. This section is similar to a script and includes your statements, actions, student actions, transitions, students' activities, distribution of materials, guiding questions and*

anticipated student responses.

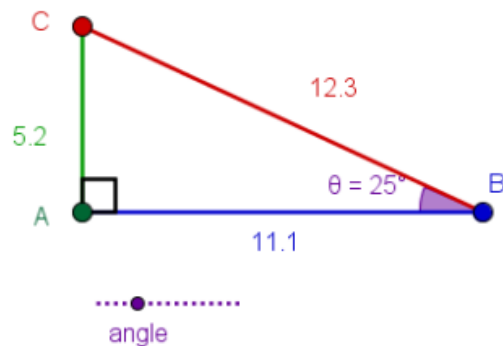
Timing: 15mins

Review: SOHCAHTOA - use clickers to do two examples

1. Calculate Trigonometry Ratios for a right triangle using SOHCAHTOA

Review: Trig. Ratio (SOHCAHTOA)

Q#1: Calculate $\sin\theta$, $\cos\theta$, $\tan\theta$ & θ° .



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{5.2}{12.3} = 0.4$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{11.1}{12.3} = 0.9$$

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{5.2}{11.1} = 0.5$$

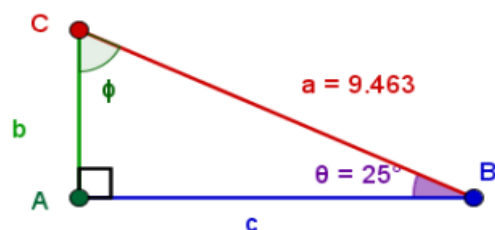
2. Calculate sides of a right triangle using SOHCAHTOA

Review: Trig. Ratio (SOHCAHTOA)

Q#2: Calculate b , c & ϕ using trigonometry ratio (SOHCAHTOA).

$$b = \text{opposite} = \text{hypotenuse} * \sin\theta = 3.999$$

$$c = \text{adjacent} = \text{hypotenuse} * \cos\theta = 8.577$$



$$\phi = \arcsin\left(\frac{8.577}{9.463}\right) = 65^\circ$$

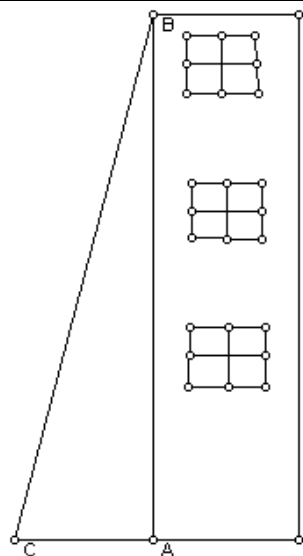
TPS Challenge Problem:

Split the class into groups of 3 and allow them to TPS this problem. This is the first application problem they have seen so it may take them time to see the relation to SOHCAHTOA. Take up the question after they have completed it.

Question:

Suppose that a 10m ladder is leaning against a building such that the angle of elevation from ground to the building is 62° . (See diagram)

- What does angle of elevation mean?
- Find the measures of the other two angles
- Find the distance from the ground to the top of the ladder.
- Find the distance from the foot of the ladder to the wall.



Answers:

a) The angle of elevation refers to the angle that's made with the horizontal line. In this case it is the angle made between the ground and the ladder.

b) The angles are 62° , 90° , and 28°
 $180^\circ - 90^\circ - 62^\circ = 28^\circ$

c) $\sin \theta = \frac{\text{opp}}{\text{hyp}}$ $\sin 62^\circ = \frac{h}{10}$ $\sin 62^\circ (10) = \frac{h}{10} (10)$ $h = 8.829 \text{ m}$

d) $\cos \theta = \frac{\text{adj}}{\text{hyp}}$ $\cos 62^\circ = \frac{x}{10}$ $\cos 62^\circ (10) = \frac{x}{10} (10)$ $x = 4.695 \text{ m}$

6.c.Application: *Connecting the lesson to real life and relevancy. This section explains how the students will apply the new learning. This typically follows instruction but could also be incorporated as part of the instruction. Examples include role playing, making a model, doing a task, creating a mind map.*

See challenge problem (TPS) above

6.d. Assessment & Consolidation: *What assessment strategies do you need to have to ensure you are accountable for the students' learning and addressing the expectations? What formative and summative assessments should you include? How will you know that they have met the learning goals? Refer back to the learning goals and success criteria, how will you know they have learned? It wraps up the lesson, allows for feedback, reviews key concepts and summarizes learning.*

Timing: 5min

Hand out a worksheet with a final question to consolidate their knowledge on Applied Trigonometry.

Solution to Worksheet

$$1. \tan \theta = \frac{h}{d} \quad \rightarrow \quad d = \frac{20}{\tan(55)} = 14.0\text{m}$$

$$2. \sin \theta = \frac{h}{wd} \quad \rightarrow \quad \theta = \arcsin \left(\frac{h}{d} \right) = 23.6^\circ$$

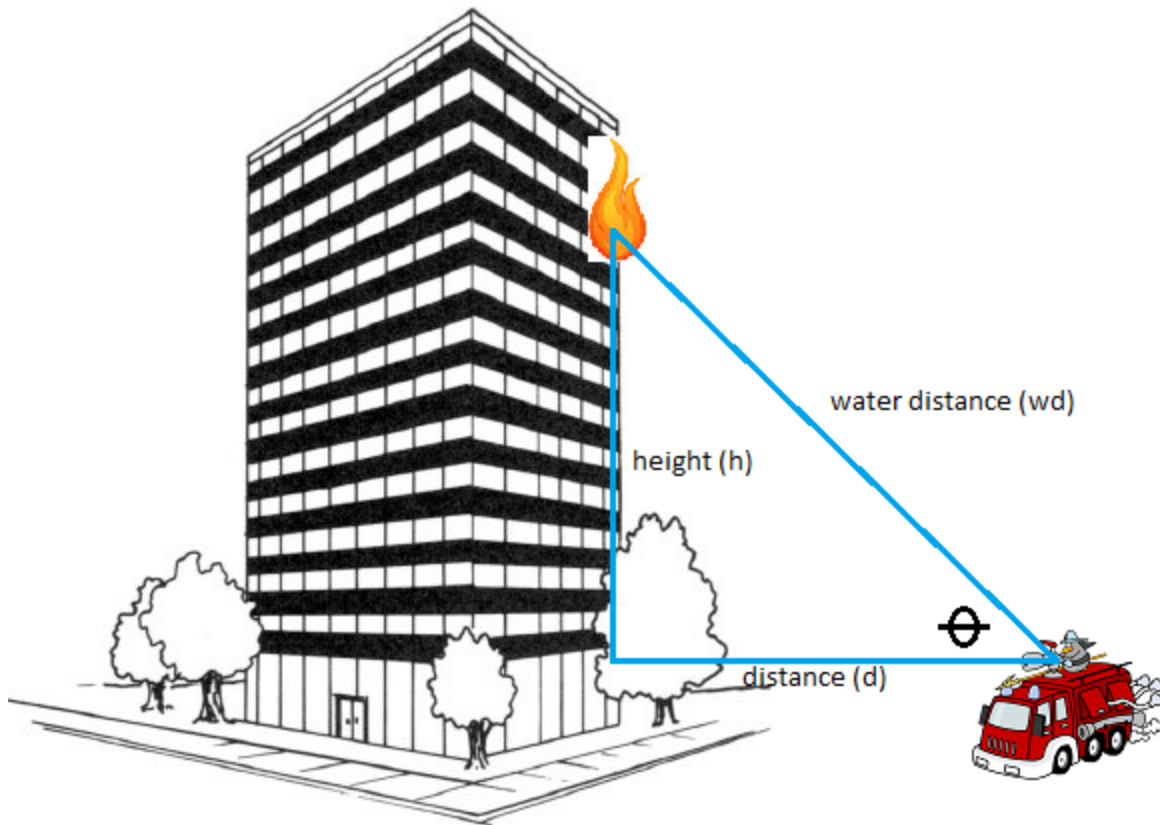
$$3. \tan \theta = \frac{h}{d} \quad \rightarrow \quad h = d \tan (\theta) = 14.3\text{m}$$

$$4. \sin \theta = \frac{h}{wd} \quad \rightarrow \quad wd = \frac{h}{\sin \theta} = 26.1\text{m}$$

$$5. \tan \phi = \frac{d}{h} \quad \rightarrow \quad \phi = \arctan \left(\frac{d}{h} \right) = 36.9^\circ$$

Worksheet:

Fire engines have water cannons which are used to assist in putting out fires. Depending on the buildings' distance (d) from the water cannon can spray water to a certain height (h) if the cannon was aimed at a particular angle (θ). Depending on how powerful the water cannon is, the water cannon can throw water to certain distance (wd) and put out the fire.



Please choose anyone of the following questions:.

1. If the water cannon can only be aimed at most 55° , how far must the fire engine be parked from the building if the fire was located 20m up?
2. If the water cannon has power to throw water to a distance of 50m and the fire was located 20m up, what is the angle the water cannon is to be aimed at?
3. If the fire engine is parked 10m from the building and the most the cannon can be aimed is 55° , how high up can the water cannon reach?
4. How far does the water travel if the water cannon is aimed at 50° to throw water on a fire which is 20m up?

Bonus:

5. If you were at the point of the fire and you were able to jump in a straight line, at what angle would you have to jump to land on the fire truck if you were 20m up and the fire truck was 15m from the building?

Worksheet → On a separate file (the images wouldn't show up)